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Valuing the commons: An international study on the recreational benefits of the Baltic Sea

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A B S T R A C T

The Baltic Sea provides benefits to all of the nine nations along its coastline, with some 85 million people living within the catchment area. Achieving improvements in water quality requires international cooperation. The likelihood of effective cooperation is known to depend on the distribution across countries of the benefits and costs of actions needed to improve water quality. In this paper, we estimate the benefits associated with recreational use of the Baltic Sea in current environmental conditions using a travel cost approach, based on data from a large, standardized survey of households in each of the 9 Baltic Sea states. Both the probability of engaging in recreation (participation) and the number of visits people make are modeled. A large variation in the number of trips and the extent of participation is found, along with large differences in current annual economic benefits from Baltic Sea recreation. The total annual recreation benefits are close to 15 billion EUR. Under a water quality improvement scenario, the proportional increases in benefits range from 7 to 18% of the current annual benefits across countries. Depending on how the costs of actions are distributed, this could imply difficulties in achieving more international cooperation to achieve such improvements.

1. Introduction

The Baltic Sea provides benefits to all of the nine nations along its coastline, with some 85 million people living within the catchment area (Ahtiainen et al., 2013). These benefits include direct use of the sea for recreation, non-use related values for individuals, transport and food production. The sea is an open access resource for neighboring nations, acting as a sink for nutrient pollution inputs from all states which has resulted in serious eutrophication problems (Hasler et al., 2014; Hyytiäinen et al., 2014; Wulff et al., 2014). Due to the fact that the nine littoral countries belong to multiple political jurisdictions (regional, national, and international), there is a degree of non-excludability in access to the Baltic Sea as a pollution sink and for fishing effort.

In the case of non-excludable international public goods, the overall well-being of parties can be enhanced by cooperative management. Despite the well-known strategic problems in incentivizing such cooperation (Barrett, 2006), multi-country cooperation to improve environmental management of the Baltic Sea has been progressively introduced, for example, by the Baltic Marine Environment Protection Commission (HELCOM). Whilst there are big differences between agreeing to sign such an

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international agreement and taking costly actions to help implement them, one important input fostering joint actions is the provision of information on the size of the potential economic benefits to each country from enhanced environmental quality (Hanley and Folmer, 1998; Finus, 2001). Such information can also help inform countries on the case for unilateral actions to improve the condition of global commons, even in the absence of international environmental agreements (Jeppesen and Andersen, 1998). Estimating aggregate recreation benefits is also important for national environmental accounting exercises (UNEP, 2012), whilst information on the benefits from changes in water quality is vital if social cost-benefit analysis is to be used to inform environmental management (Hanley and Barbier, 2009).[1]

The objectives of this paper are thus (i) to estimate and then compare the aggregate recreation benefits which are obtained from access to the Baltic Sea across all nine countries that border the sea; and (ii) to simulate the likely change in these benefits should water quality be improved. We provide these estimates by applying a method based on consumers' revealed preferences using the data obtained from a unique, standardized survey administered to large representative samples in each of the littoral countries of the Baltic Sea.

Many studies have been undertaken world-wide using both stated and revealed preference methods to estimate the economic benefits from improved coastal water quality, including studies which look specifically at impacts on recreation. An overview of early work is provided in Hanley et al. (2003b). Recreation demand values for improvements in coastal water quality are also reported in a wide range of studies for UK (Hanley et al., 2003a), US (Poor and Breece, 2006), Australia (Rolfe and Gregg, 2012), South Africa (Nahman and Rigby, 2008) and many developing countries (Mathieu et al., 2003; Mwebaze and MacLeod, 2013). More broadly, Ahtiainen and Vanhatalo (2012) use meta-analysis to examine the benefits of improved water quality in Europe and Ghermandi and Nunes (2013) derive a global map of coastal recreation values, whilst Luisetti et al. (2014) discuss the problems in estimating and aggregating ecosystem service values in coastal environments. Paracchini et al. (2014) analyze, assess and discuss outdoor recreation in the EU as an ecosystem service value, including water related recreation.

Previous studies of water quality valuation in the Baltic Sea have mainly used stated preference methods (Markowska and Żylicz, 1999; Atkins et al., 2007; Eggert and Olsson, 2009; Kosenius, 2010; Ahtiainen et al., 2014). Existing travel cost studies of the value of water quality improvements to the Baltic Sea are few (Sandström, 1996; Soutukorva, 2005; Vesterinen et al., 2010), and there are no internationally comparable estimates of water recreation values.

Sandström (1996) and Soutukorva (2005) both apply the random utility model to estimate the benefits of improved water quality for Swedish seaside recreation and the Stockholm Archipelago respectively. Vesterinen et al. (2010) apply a travel cost method combined with water clarity data on lake and seashore recreation in Finland, focusing on individual's home municipalities. However, our paper is the first to provide comprehensive estimates of the recreational value of the Baltic Sea for all nine littoral countries. The unique characteristic of our study is that the data were collected using identical surveys in nine countries, thus providing an excellent opportunity for empirical analyses and cross-country comparisons of recreation values.

The paper is structured as follows. Section 2 introduces the modeling approaches used in the study. Section 3 describes design and implementation of the empirical study and data. The estimates of the recreational value and changes resulting from improved water quality are presented in Section 4. The last section provides discussion and conclusions.

2. Methods

Economic valuation of recreation benefits using the travel cost method (TCM)[2] is based on the simple observation that the benefits to individuals of outdoor recreation opportunities are revealed in their recreation behaviors — specifically, that they are willing to spend time and money to access a particular site to spend recreational time there (Hotelling, 1947). The TCM treats the number of trips an individual makes to a site as the quantity demanded, whilst the travel costs of the trip are treated as an approximation of the price paid for each visit. These assumptions, coupled with assumptions about the separability of the demand for recreation relative to the demand for other goods from which people derive utility, and weak complementarity between utility from trips and travel expenditures, result in a demand function of the following form (Freeman, 2003):

$$r_i = f(p_i, \mathbf{z}_i), \tag{1}$$

where r_i is the number of trips taken by individual i to a given site during a given time period, p_i is the cost incurred in getting to a site (which usually consists of the cost of travel and opportunity cost of travel time, Czajkowski et al., 2015), and $\mathbf{z}_i$ is a vector of individual characteristics that are believed to influence the number of trips an individual takes.

Since $f(\cdot)$ represents the demand function, consumer i's surplus associated with a trip can be calculated as the following integral:

$$CS_i = \int_{p_i^0}^{p_i^{\cdot}} f(p_i, \mathbf{z}_i) \mathrm{d}p_i, \tag{2}$$

where p_i^0 is the trip cost and $p_i^{\cdot}$ is the cost at which the number of trips by that individual goes to zero, also called a ‘choke price’.

Since the number of visits an individual makes to a site is always an integer value, the standard approach for modeling recreation demand is to apply count data models, namely Poisson and Negative Binomial regressions or their generalizations. In the Poisson model, the probability that individual i takes k trips to the site is given by:

$$P(y_i = k) = \frac{\lambda_i^k}{k!} e^{-\lambda_i}, \tag{3}$$

where $\lambda_i = \exp(\boldsymbol{\beta}\prime \mathbf{x}_i)$ and $\mathbf{x}_i$ is a vector of individual characteristics. Even though Poisson regression assumes equi-dispersion, i.e., $E(y_i) = Var(y_i) = \lambda_i$, uncommonly found in practice, this simple specification still produces consistent parameter estimates. Nonetheless, models that allow for under- or over-dispersion are often better fitted to the data. In a Negative Binomial regression the probability that i’th individual takes k trips to the site is given by:

$$P(y_i = k) = \frac{\Gamma(\alpha^{-1} + k)}{\Gamma(\alpha^{-1})\Gamma(k+1)} \left(\frac{\alpha^{-1}}{\alpha^{-1} + \lambda_i}\right)^{\alpha^{-1}} \left(\frac{\lambda_i}{\lambda_i + \alpha^{-1}}\right)^k, \tag{4}$$

[1] For example, the European Union Marine Strategy Framework Directive (MSFD) requires cost-benefit analysis of measures to improve the state of marine waters.

[2] For a general overview of the method see Hanley and Barbier (2009).